Protection and immune responses against virulent Infectious Bronchitis (IB) viruses in Herpesvirus Turkey – Infectious Bursal Disease (HVT-IBD) vaccinated broiler chicks

Lemiere Stephane¹, Wilkins Matthew², Forrester Anne², Jones Richard² & Ganapathy Kannan²

¹ Merial S.A.S., 29 avenue Tony Garnier 69348 Lyon cedex 07 France
² University of Liverpool Leahurst Campus, Neston South Wirral CH64 7TE United Kingdom

Abstract

This paper evaluates the performance of broiler chicks that were vaccinated with two different IBD vaccines, i) HVT-IBD vector vaccine, ii) IBD-complex used as the control vaccine. Broiler chicks were divided to 3 groups in the hatchery; the first group was kept unvaccinated, the second and third groups were subcutaneously vaccinated with HVT-IBD vector vaccine or control vaccine respectively. One of each HVT-IBD vector vaccine and control vaccine groups was vaccinated with IB Mass H120 at day old and later with IB virus CR88 at 13 days old. The other group from each of the IBD-vaccinated groups remained as controls. At 7, 14, 21, 28, 35 and 42 days post vaccination, blood was collected for sera (for IB and IBD serology) and 5 chicks from each group sacrificed to determine bursa:body weight ratio (b/bw). In addition tissues of trachea, lungs, kidneys, caecal tonsil and rectum were collected for detection of IB virus by RT-PCR. At 35 days post vaccination, 10 chicks from each group were challenged with virulent M41 or virulent IB QX strain KG3P. Five days later, 5 chicks were euthanized for ciliary score and another 5 for collection of various tissues. Bursa integrity as determined by b/bw ratio was used to measure the HVT-IBD vector vaccine efficacy. No difference in terms of clinical protection against respective IB virus challenges was evidenced, nor was a difference in post-IB vaccine application. The main finding was a decreased dissemination of the M41 virulent virus in tracheas of challenged birds with protected bursas, as well as a decreased dissemination of the QX virulent virus in kidneys of challenged birds with protected bursas, demonstrating the benefit of getting bursa integrity after the HVT-IBD vector vaccine application.

Introduction

Preliminary field observations of monitoring of serology after HVT-IBD vaccine application showed that an increased ELISA anti-IB virus titer was detected, as compared to classical IBD live vaccine programs. This led to the request to test the interaction between HVT-IBD vector vaccine and IB vaccination in laboratory conditions. This paper evaluates the performance of broiler chicks that were vaccinated with two different IBD vaccines, i) HVT-IBD vector vaccine (Merial S.A.S., Lyon, France), ii) IBD-complex commercial vaccine marketed in the United Kingdom, used as the control vaccine. The IB vaccination program was heterologous, associating at day-old a Mass strain vaccination and a revaccination with a CR88 variant strain at D14 of age [2].
Material & methods

At hatchery, broiler chicks were divided to 3 groups. The first group was kept unvaccinated. The second and third groups were subcutaneously vaccinated with HVT-IBD vector vaccine [1] or control vaccine respectively. One part of each HVT-IBD vector vaccine and control vaccine groups was vaccinated with IB Mass H120 at day old and later with IB CR88 at 13 days old. The other part of the groups from each of the IBD-vaccinated groups remained as controls (Table 1). At 7, 14, 21, 28, 35 and 42 days post vaccination, blood collected for sera (for IBD and IB serology), 5 chicks from each group sacrificed to determine bursa:body weight ratio (b/bw), also tissues of trachea, lungs, kidneys and caecal tonsil were collected for detection of IB virus by RT-PCR.

Table 1: Vaccination programs

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of chicks</th>
<th>Vaccination (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unvaccinated</td>
<td>40</td>
<td>D1</td>
</tr>
<tr>
<td>HVT-IBD vector vaccine-vaccinated</td>
<td>60</td>
<td>H120 CR88</td>
</tr>
<tr>
<td>Control vaccine = live IB vaccine in complex with Antibodies-vaccinated</td>
<td>60</td>
<td>H120 CR88</td>
</tr>
</tbody>
</table>

At 35 days post vaccination, 10 chicks from each group were challenged with virulent M41 or virulent IB virus QX strain KG3P. Five days later, 5 chicks were euthanized for ciliary score and another 5 for collection of various tissues. Bursa integrity measured by b/bw ratio was evidenced further to HVT-IBD vector vaccine application.

Results / discussion

Bursa integrity measured by b/bw ratio was observed further to HVT-IBD vector vaccine application (Figure 1). Post-vaccination IBD vaccine intake was shown with IBD ELISA serology (Figure 2) in all the IBD vaccinates, whatever the vaccine used, the HVT-IBD vector vaccine or the control. Trends to decrease of dissemination of IB vaccine viruses to target organs as kidneys and caecal tonsils were shown in the HVT-IBD vector vaccine vaccinates.

No difference in terms of clinical protection against respective IB virus challenges was observed (> 98% of protection against M41 challenge in IB vaccinated groups and >90% of protection against QX KG3P challenge in IB vaccinated groups whatever their bursa integrity status), neither a difference in post-IB vaccine application (Figure 3). The main finding was a decreased dissemination of the M41 virulent virus in tracheas of challenged birds with protected bursas (Table 2), as well as a decreased dissemination of the QX virulent virus in kidneys of challenged birds with protected bursas (Table 3), demonstrating the benefit of getting bursa integrity after the HVT-IBD vector vaccine application when vaccinating against IB with live vaccines.
Table 2: RT-PCR Mass M41 virus recovery from target organs

<table>
<thead>
<tr>
<th>RT-PCR</th>
<th>Unvaccinated</th>
<th>HVT-IBD vector vaccine + IB vaccines</th>
<th>HVT-IBD vector vaccine</th>
<th>Control vaccine + IB vaccines</th>
<th>Control vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T L K CT</td>
<td>T L K CT</td>
<td>T L K CT</td>
<td>T L K CT</td>
<td>T L K CT</td>
</tr>
<tr>
<td>Number % positive</td>
<td>2 5 2 1 0 4 3 5</td>
<td>1 2 4 4 4 3 2 5</td>
<td>4 5 5 4</td>
<td>80 100 100 80</td>
<td></td>
</tr>
<tr>
<td>% positive</td>
<td>40 100 40 20 0 80 60 100</td>
<td>20 40 80 80 80 60 40 100</td>
<td>80 60 40 100</td>
<td>80 100 100 80</td>
<td></td>
</tr>
</tbody>
</table>

T = trachea, L = lung, K = kidney, CT = caecal tonsil

Table 3: RT-PCR QX KG3P virus recovery from target organs

<table>
<thead>
<tr>
<th>RT-PCR</th>
<th>Unvaccinated</th>
<th>HVT-IBD vector vaccine + IB vaccines</th>
<th>HVT-IBD vector vaccine</th>
<th>Control vaccine + IB vaccines</th>
<th>Control vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T L K CT</td>
<td>T L K CT</td>
<td>T L K CT</td>
<td>T L K CT</td>
<td>T L K CT</td>
</tr>
<tr>
<td>Number % positive</td>
<td>2 0 0 0 0 0 0 0 5</td>
<td>0 0 0 0 0 0 3 5 0</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>% positive</td>
<td>40 0 0 0 0 0 0 100</td>
<td>0 0 0 0 0 0 60 100</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
<td></td>
</tr>
</tbody>
</table>

T = trachea, L = lung, K = kidney, CT = caecal tonsil

Conclusion

Enhanced protection induced by IB vaccination program was evidenced in the group displaying integrity of bursas further to HVT-IBD vector vaccine application.

References

Figure 1: Bursa:body weight ratio monitoring

![Bursa/Body Weight ratio graph]

Legend:
- Control vaccine IBV
- HVT-IBD vector vaccine IBV
- Control vaccine
- HVT-IBD vector vaccine
- Unvaccinated

Figure 2: IBD ELISA (VP2 increased affinity) antibody monitoring

![IBD ELISA plus graph]

Legend:
- Control vaccine IBV
- HVT-IBD vector vaccine IBV
- Control vaccine
- HVT-IBD vector vaccine
- Unvaccinated
**Figure 3:** IB ELISA antibody monitoring